output which has been accomplished. Especially helpful was his knowledge of men and their business capacity, and the Ministry owes much to him in this, not only in the particular section he had in charge, but throughout the organisation."

He was the author of papers on "Propulsion on Canals" and "Light Railways," and translated "Marine Boilers," by M. Bertin, Chief Constructor of the French Navy.

NOTES.

WE learn with deep regret that Prof. Silvanus P. Thompson, F.R.S., died on June 12, a little before midnight, at his residence in West Hampstead, after only two days' illness.

THE meeting of Scandinavian naturalists, to be held in Christiania on July 10–14, will be attended by not fewer than 500 members. The papers announced number 142.

THE Bill to advance legal time by one hour during the period from June 14–15 to September 30–October 1 has been passed by the French Senate and the Chamber of Deputies, so that French time now corresponds to British Summer Time.

THE rescue of the twenty-two members of Sir Ernest Shackleton's expedition who are now marooned on Elephant Island is to be undertaken by a steam-trawler belonging to the Fisheries Department of Uruguay. The vessel was built in Aberdeen in 1906 for the North Sea fishing fleet. She was expected to leave Buenos Aires on June 9, and to call at the Falkland Islands, where she would be joined by Sir Ernest Shackleton, on June 13. They are nearer than South Georgia to Elephant Island, which, if all goes well, should be reached in four days from the Falklands. The trawler has been fitted with wireless apparatus, and communication will be maintained with her by a British auxiliary cruiser, which will be stationed in Drake's Strait. It is therefore possible that news of the rescue of Wild and his comrades may be received on June 18, and the party may be back in South America before the end of the month. With regard to the Ross Sea, the Secretary of the Admiralty announces that the rescue of the men left ashore when the *Aurora* was blown away from her winter quarters at Cape Evans will be carried out at the end of this year in the *Aurora*, with the co-operation of the Governments of the Commonwealth of Australia and the Dominion of New Zealand.

WE regret to learn that among the officers killed in the naval action in the North Sea on May 31 was Commander H. L. L. Pennell, R.N., who lost his life by the sinking of H.M.S. *Queen Mary*. Commander Pennell, who was thirty-four years of age, joined the *Britannia* in 1898, and became a midshipman next year. In 1903 he was promoted lieutenant, and after several years' distinguished service was selected by the late Capt. R. F. Scott to be one of the officers of the *Terra Nova* in the British Antarctic Expedition of 1910. When Capt. Scott and the main wintering party had landed in McMurdo Sound early in 1911, Lieut. Pennell took the *Terra Nova* east, along the Ross Barrier, and found Amundsen in the *Fram* at his winter base. Lieut. Pennell afterwards landed the second wintering party at Cape Adare, and in the following summer moved them further south. He was in command of the *Terra Nova* throughout the expedition, and it was he who, on the return to New Zealand, discovered the westward trend of the north coast of Victoria Land, which he named Oates Land. On his return from the Antarctic in 1913 Lieut. Pennell was promoted commander in the Navy.

THE *Morning Post* of June 5 contains some of the impressions of life in Germany, particularly of the scientific activity, received by a neutral lately returned from Berlin. The general view of the greater scientific efficiency of Germany is confirmed, and the German interest in science as a source of profit is contrasted with the study of science for its own sake in this country. We learn that German chemists introduced a gaseous arsenic compound for military use which could be fired into the enemy ranks in cases which exploded on arrival. Fortunately, however, for the Allies' troops, the gas decomposes and becomes innocuous when fired from a gun. The manufacture of synthetic rubber (particularly for motor-car tyres) is said to be a great success, but the process is a competitor with the manufacture of explosives for the limited supply of benzol. The neutral observes that the scientific experiments with bread have been less encouraging, its quality having become worse, whilst the indigestible portion has increased in amount this year. The people are suffering privations from insufficiency and poverty of food, the effects being loss of weight and an illness caused by unwholesome diet. Great hopes are reposed in the coming harvest, towards the abundance of which science has done its share by providing nitrates manufactured from atmospheric nitrogen.

IT is worthy of note that the Addington-Wickham bourne is now flowing, a phenomenon of very rare occurrence. The last flow of any magnitude was in 1883, when more than three million gallons of water per day were gauged by Mr. Baldwin Latham near Hayes. Since that date two water pumping-stations have been built in this valley, the combined pumping of which has resulted in the present bourne being reduced to 1,600,000 gallons a day, as measured recently by Mr. Latham. The bourne is interesting as being essentially the highest source of the Ravensbourne. It now commences in springs in a field near to Addington village. Many springs can be seen feeding it in the fields in the valley, and it has filled up two large gravel pits near the Hayes railway. It passes under the railway and, crossing the road, reaches what for many years has been the source of the Ravensbourne. The present source, although now on the chalk, has to well up through a considerable thickness of gravel. It is surmised that in times when the Croydon and other bournes are out, this one remains invisible owing to its flowing over the chalk but under the gravel, and only on exceptional occasions it appears at the surface. It would seem that a good deal of underground solution is going on, judging from the manner in which the banks around the spring-heads have been let down below the surrounding levels.

THE "Report of the Committee on Edible and Oil-Producing Nuts and Seeds" of West Africa [Cd. 8247], just issued, affords an interesting glimpse of the changed attitude of the Government towards science and industry, brought about by the war. The exports of oilseeds and oils from British West Africa in 1913 were valued at 7,228,000*l*., and of this amount Germany took no less than 3,869,000*l*., chiefly in the form of palm kernels, the crushing of which for oil and cake she had practically monopolised. The outbreak of war placed British West African exporters in a serious position, the usual channel for more than half their exports of oil and oilseeds being stopped. The story of how this difficulty was met and a new British industry in the crushing of palm kernels organised is told in Prof. Dunstan's introduction to

"Oil-seeds and Feeding-Cakes" (London: John Murray, 1916), and need not be repeated here. The action taken was so successful that when the Oilseeds Committee began its investigations in June, 1915, it was in the fortunate position of merely having to consolidate an industry instead of having to create one. Full justice is done in the report to the work of the Imperial Institute, the British agricultural colleges, and the Board of Agriculture, all of which took part in the scientific, technical, and commercial investigations which led to this successful result. The Committee makes four recommendations with a view to the retention of the new industry in British hands after the war, and of these two are to be put into immediate action, in accordance with instructions contained in a despatch from Mr. Bonar Law to the Governments of Nigeria, Gold Coast, and Sierra Leone, printed with the report. The first of these is the imposition of an export duty of *2l.* per ton, or more if necessary, on all palm kernels exported from West Africa to ports outside the British Empire. The second recommendation is that the West African Departments of Agriculture and Forestry should take measures to continue and extend their investigations of the oil palm, and that "these measures should be taken in co-operation on the scientific and technical side with the Imperial Institute, by which admirable work has been done in the past in connection with the oil palm, and to which much of the existing knowledge of the palm and its economic products is due."

THE care expended on the well-being of the animals in modern zoological gardens is well illustrated in the forty-fourth annual report of the Zoological Society of Philadelphia, which we have just received. As in the Gardens of the Zoological Society of London, the most searching post-mortem examination is instituted in the case of every death, and as a result discoveries are made the importance of which is not to be measured by their immediate value to the society concerned. In the present report the most interesting items are a mysterious epizootic among the waterfowl, and of an arachnoid parasite in the lungs of monkeys. The lesions they produce simulate, and may be mistaken for, tubercles. But their presence does not seem seriously to affect the host. The original habitat and mode of transmission are unknown, but no fewer than four different species have been described, and have been taken from monkeys both in India and Africa, as well as from captive specimens.

DEAD bodies of the short-tailed petrel, to the number of many hundreds, have periodically been found along the beach at Ulladulla, New South Wales, and a like mortality prevails on some islands a few miles off the mainland. Naturally such discoveries have given rise to much speculation among ornithologists. As a rule it is attributed to disease, starvation, or storms. But Mr. G. Basset Hull, in the *Emu* for April, advances what seems to be a much more probable explanation—to wit, that these are the victims of the struggle for breeding territory with the larger and more powerful wedge-tailed petrel. Support is lent to this view from the fact that on one island, where the wedge-tailed species were breeding in large numbers, no burrows were found tenanted by the short-tailed species, but their dead bodies were found outside the burrows of their larger rivals. If, indeed, the smaller species is harried, buffeted, and finally driven off in an exhausted state by the larger, then the struggle for existence in the case of the short-tailed petrel must be indeed severe. It is to be hoped that an attempt will be made to set this matter at rest, for it raises a point of quite exceptional interest.

IN the *Australian Zoologist* (vol. i., part 3) Dr. A. S. Le Souef, the director of the Zoological Gardens, Sydney, records some interesting colour variations of opossums of the genus Trichosurus. The general coloration of the common opossum (*Trichosurus vulpecula*) is grey above, whitish below. The variants on this are rufous, black, and fawn, but it seems difficult to associate such variations with environmental conditions. Thus "brown" coloured individuals are most common in Tasmania, and appear to be confined to the moist, heavily timbered districts; but on the mainland brown-coloured specimens are very common, "particularly in the drier districts." The descendants of the Tasmanian opossum turned out at Lyttelton, New Zealand, some five and twenty years ago already show variation from the typical form, since the animals have become darker and the fur longer and less dense. The author suggests that Mr. Oldfield Thomas, of the British Museum, was in error when he described the mountain opossum (*T. caninus*) as brown in colour. This hue appears only in the black opossum after it has been partially depigmented by immersion in spirits. The existence of the black opossum is here recognised for the first time, being designated a distinct subspecies (*T. caninus nigrans*). This well-marked subspecies "is found in the heavy coastal scrubs in north-eastern New South Wales and southern Queensland."

IN the report of the South African Museum for 1915, just issued, Dr. L. Péringuey, the director, relates a very extraordinary occurrence. While the troops of the Union were camped in the wide sand-belt of Luderitzbucht and Swakopmund, waiting to advance inland, there appeared, suddenly, after heavy rains—a thing almost unheard of in those parts—all along the line, immense swarms of moths. The fact is the more extraordinary and mysterious since these sands are almost void of visible vegetation. That they were brought by the wind from inland Dr. Périguey considers improbable. They disappeared as rapidly as they came. Samples which were sent to the museum proved to consist of no fewer than twenty species of Noctuidæ. In this report mention is also made of the fossilised skull of the "Boskop" man found in the Transvaal, and of fragments of limb-bones, probably of the same skeleton. This skull, which seems to be remarkable for its great length, has not yet been described in detail. It is much to be hoped that this will soon be done. A mandible found in the river-gravels at Harrismith, in the Orange Free State, and stone implements found in another locality in the Orange Free State, are also mentioned among the acquisitions for the year deserving special mention.

IN an article under the title "The Reflex as a Creative Act" (Bull. Imp. Acad. Sci., Petrograd, November, 1915), the eminent Russian biologist S. I. Metalnikov discusses the nature of reflex action, and contests the position of those biologists and physiologists who maintain (*a*) that reflex action presupposes the existence of a central nervous system; (*b*) that reflexes are unconscious and involuntary; (*c*) that they are uniform and invariable. If, he says, we concede these premises we are at the outset brought up against a whole series of difficulties. In many of the lower Invertebrata, and in all unicellular organisms, the most careful research fails to reveal any central nerves, yet they react to various stimuli no less than the higher organisms. Further, we can never determine by direct observation whether a reaction is voluntary or involuntary. And, lastly, even as no two organisms are exactly alike, so there are no two absolutely similar reactions. The reactions of Protozoa are never uniform. Even in Amœba they are so varied as to be scarcely ever twice alike. After describing some experiments on Paramœcium, the author maintains that every reaction produces a definite modification in the living tissue, and may therefore be considered as closely connected with the creation of the personality, and he concludes a closely reasoned dissertation in these words:—"The life of every organism is an uninterrupted creation, and this individual creation, the cause of endless variety, is but a small part of that larger creative cycle which we call evolution."

DR. JOHS. SCHMIDT, in vol. xxiii. of *Rapports et Procès-verbaux du Conseil International pour l'exploration de la mer,* gives a further contribution of his studies on the natural history of the eel. The paper deals with the question of the existence of "smaller species" or "races" of the European eel, and with the distinguishing features of this species, of the American and of the Japanese eel. The characters investigated include the number of vertebræ, the number of rays in different fins, and the number of branchiostegal rays. The conclusion arrived at is that, whilst the three species investigated are clearly marked the one from the other, it has not been found possible to distinguish between different "races" of the European eel. The most convenient character is the number of vertebræ. The author brings forward a point of considerable biological interest by comparing the condition found amongst the eels with that found in the viviparous blenny (*Zoarces viviparus*), a species having about the same number of vertebræ as the eel. He finds that samples of Zoarces taken from closely adjacent localities in Danish waters may differ one from another as regards number of vertebræ to a higher degree than does the European eel from the American eel in respect of the same character, and that, whereas *Zoarces viviparus* in the north of Europe is divided up into numerous distinctly different stocks or populations according to locality, all the eels of Europe are identical. This difference the author considers must be due to the fact that all European eels have the same origin in the spawning grounds of the Atlantic Ocean. The blenny, on the other hand, is viviparous and has no pelagic stage, so that it is highly localised, and specimens collected, for instance, in the inner waters of a fjord may have a lower number of vertebræ than those taken at the mouth. Whether this is due to "genotypic differences" or to the immediate effect of varying external conditions, the author hopes to make a matter of direct experiment.

THE Government of Madagascar has issued the "Annuaire Général de Madagascar et Dépendances" for 1916. The war has affected the size of this year's volume, which takes the form of a supplement and corrections to the issue for 1914. Among a great deal of matter the most useful from a geographical point of view is the account of the railways, to which is added a large-scale map. There is also a short account of the chief roads, and of the navigable waterways. The last part of the volume is occupied with trade statistics.

VOL. 1 of Agricultural Statistics for India, 1913–14, which deals with British India, demonstrates a noteworthy steadiness of agricultural operations during recent years. In the preceding decade the total area cropped, the areas sown with rice, millets, wheat, sugar, cotton, jute, and oil-seeds, suffered but slight fluctuations. The cropped area which has been irrigated and the area devoted to food crops have both increased, the former by 30 per cent. In the whole of India 80 million acres are sown with rice, which is ten times the acreage in Japan; 29 million acres with wheat, which is only exceeded by the wheat acreage of the United States; and 25 million acres with cotton, which is two-thirds of the cotton acreage of the United States. About one-eighth of the Indian area is cropped more than once. The exceptions to the general conditions are indigo and opium, which have declined in acreage by about a half since 1909. In the latest year the area devoted to cinchona was increased by a tenth; this increase is due to a great extension of the cultivation in Bengal, the acreage having declined in Madras, which is the other chief growing district. Nearly half the sugar-cane is produced in Agra, where the area under this crop is being increased. A third of the cropped area in Madras and the United Provinces, a half in the Punjab, and three-quarters in the district of Sind depend upon irrigation from canals, tanks, or wells for their water supply.

THE fifth volume of the special reports on the "Mineral Resources of Great Britain" has just been issued by the Geological Survey (London: H.M. Stationery Office and E. Stanford, Ltd.; price 1s.). This is rather more miscellaneous in scope than its predecessors, and deals with a number of mineral substances between which there is neither economic nor geological relationship, namely:—Potash-felspar, phosphate of lime, alum shales, plumbago, molybdenite, chromite, talc and steatite, diatomite. It will be noted that some of these substances, like alum shales, are being worked to-day; others, like plumbago, have given rise to important mining operations in the past; and others again, like molybdenite, never have been worked in this country, nor does there seem to be much probability as regards this mineral that workable deposits are likely to be discovered. It might be suggested that in such a case as the last-named rather more attention might be devoted to the known occurrences within the Dominions of Greater Britain. The first article in the volume is perhaps the most interesting, because the discovery of an economically workable British source of potash is one of the great needs of the moment. It is curious to note that in the section dealing with the extraction of potash from felspar foreign authorities are freely quoted, but no reference is made to an exhaustive recent article on the subject in the Journal of the Society of Chemical Industry (April 30, 1915). If the present work serves to direct the attention of chemists and geologists to this important subject, nothing but good can result; indeed, it seems strange that, at a moment when committees by the score are being created to advocate researches into all manner of subjects, some of them, perhaps, of but remote practical interest, the important question of potash supply has not received more attention. It would indeed be a wise move if the Board of Agriculture would offer a handsome prize as an inducement to chemical investigators to work at this problem, which, although admittedly difficult, should not be incapable of solution.

AN interesting addition to the existing literature on the eruptions of the volcano Stromboli has come to our notice in the form of a collection of papers published in a particularly interesting number of the *Atti dei Lincei,* xxv. (1), 5. It was after an interval of twenty-four years that an eruption characterised by copious flows of lava made its first appearance in June, 1915, and Prof. Gaetano Platania and Prof. Gaetano Poute were deputed to study the phenomena, being assisted in this work by an American vulcanologist, Mr. F. A. Perret. The papers here referred to describe separately the individual experiences of the three observers, Profs. Platania and Poute contributing their own observations, while those of Mr. Perret are detailed in a paper by Prof. A. Riccò.

Although figures of equilibrium of rotating liquids have already been fairly thoroughly studied by the late Sir George H. Darwin and others, a fresh method of approximate solution of the problem, by Prof. A. Liapounoff, appears in the Bulletin of the Petrograd Imperial Academy of Sciences, vi. (April 15). The principal feature of this method is that, after obtaining an equation which is not in itself soluble, the author substitutes an approximate formula, which may be taken as equivalent to the previous one to a sufficient degree of accuracy within the limits involved in the calculation and overcomes the mathematical difficulties.

The May issue of Section A of the Proceedings of the Royal Irish Academy contains three papers by Prof. McClelland and his assistants which deal with methods of production and detection of ions in the atmosphere. In the first of the series it is shown that leaves exposed to the ultra-violet light of an electric spark between aluminium electrodes show the photoelectric effect to an extent which in some cases is a tenth of that shown in the same circumstances by copper. A cold-water extract from the leaves may show an activity a third of that of copper, while an acetone extract shows no activity. A few drops of the acetone solution will, however, render a large volume of water strongly active. The other papers relate to the ions produced when water is sprayed into air or air bubbled through mercury. In both cases the saturation curves of the air show that there are four or five kinds of ions present in it with mobilities which vary from those of the large Langevin ions to those of the ordinary small ions, while there appear to be present in addition at least two types of ions with still greater mobilities.

A very timely and valuable essay on "Zinc, its Production and Industrial Applications," by Mr. J. C. Moulden, was recently read in abstract at a meeting of the Royal Society of Arts. This essay was the result of a prize founded by Mr. Reginald Le Neve Foster in memory of his father, a former secretary of the society from 1853 to 1879, the subject being determined by the council. The publication is one of considerable length, and extends over two weekly issues of the society's journal. It opens with an account of the physical and chemical properties of the metal, and then passes to a consideration of its history, from which it appears that although it played no part of any importance in the economics of the ancients it was known to them both as the metal and in the form of alloys. The first zinc smelting works were established in this country at Bristol in 1743 by John Champion. He also secured a patent in 1758 for the winning of brass and zinc from blende as a substitute for calamine, which hitherto had been the sole source of the metal. Succeeding sections deal with zinc ores, their nature, occurrence, and distribution, and the metallurgy of the metal. The essay should be of great service, appearing, as it does, at a time when the possibility of establishing a great zinc industry in this country is being carefully considered.

The U.S. Bureau of Standards has recently issued a circular (No. 58) entitled "Invar and Related Nickel Steels," which is mainly a compilation from sources, many of them inaccessible, as to the properties of nickel steels, with particular reference to the properties of the non-expanding alloy known as "invar." This should prove to be an exceedingly useful publication. After a brief historical introduction the following properties receive attention: (*a*) Reversible and irreversible nickel steels, their equilibrium diagram, microstructure, and constitution. (*b*) Magnetic properties. (*c*) Electrical properties. (*d*) Thermal expansion. (*e*) Transitory length variations following temperature changes. (*f*) Permanent changes in length at constant temperature. (*g*) Elongation of invar with time. (*h*) Rapidity of invar transformations. (*i*) Effect of composition on instability. (*j*) Reproducibility of properties of invar. (*k*) Density. (*l*) Mechanical properties. (*m*) Resistance to corrosion. (*n*) Applications, sources of supply, and bibliography. The knowledge of ferro-nickels goes back to the year 1822, when Stodart and Faraday published a paper. It was in 1889 that James Riley, of Glasgow, described, before the Iron and Steel Institute, his epoch-making investigation which disclosed the remarkable mechanical properties of nickel steels. His alloys contained various amounts of nickel up to 49 per cent., which had been prepared for him in France by Marbeau. The above circular may be obtained free by addressing a request to the Bureau of Standards.

OUR ASTRONOMICAL COLUMN.

Comet 1916*b* (Wolf).—The following ephemeris is a continuation of that given in Nature of June 1 for Greenwich midnight:—

	R.A. h. m. s.	Decl ° ′
June 21	12 29 31	+4 45·4
25	30 14	4 44·2
29	31 10	4 41·6
July 3	32 18	4 37·6
7	33 39	4 32·3

Correction.—The comet's distance on July 3 will be 400 million miles, *i.e.* ten times the figures given by error in the note referred to above.

The Solar Activity.—Another very large, active, spot disturbance has appeared. The following spot has developed considerably since Monday. The larger spot has been seen with ease, using a small glass magnifying five times. Extremely bright faculæ have been noticed (June 13) on the eastern limb.

The New Draper Catalogue.—The seventieth annual report of the Harvard Observatory contains the extremely interesting announcement that the first step in the formation of the monumental New Draper Catalogue—the classification of the stellar spectra—has been completed. The number of spectra classified is 233,050, covering the entire sky from the North Pole to the South.

The Spectrum of Coronium.—The new red line in the spectrum of the corona, shown by M. Carrasco to be a member of the same series as λ 5303·3, has enabled Prof. Nicholson to extend his analysis of the coronal spectrum to include the six outstanding lines, whence the conclusion is arrived at that the Coronium atom is a simple-ring system with nucleus 7*e*. When it has eight electrons or a single negative charge it emits the lines λλ 6374·5, 5303·3, 4566·0, 4359·0, 3642·5, and 3534·0. The lines in the spectra of neutral or of positively charged atoms are found to be situated too far in the ultra-violet for observation (No. 5, Monthly Notices, Royal Astronomical Society).

The Visibility of Stars in Daylight.—M. Bigourdan's researches in the history of astronomy have brought to light some interesting facts concerning early modern observations of stars in daylight (*Comptes rendus*, No. 22). The earliest record appears to be a note found by Zach among the papers of J. Gaultier, stating that the latter at Aix-en-Provence observed Mercury on March 1, 1611, at 6h. 30m. a.m.—the sun would then be above the horizon. The daylight observation of stars proper appears to date from May 2, 1632, when W. Schickhard first saw Regulus.